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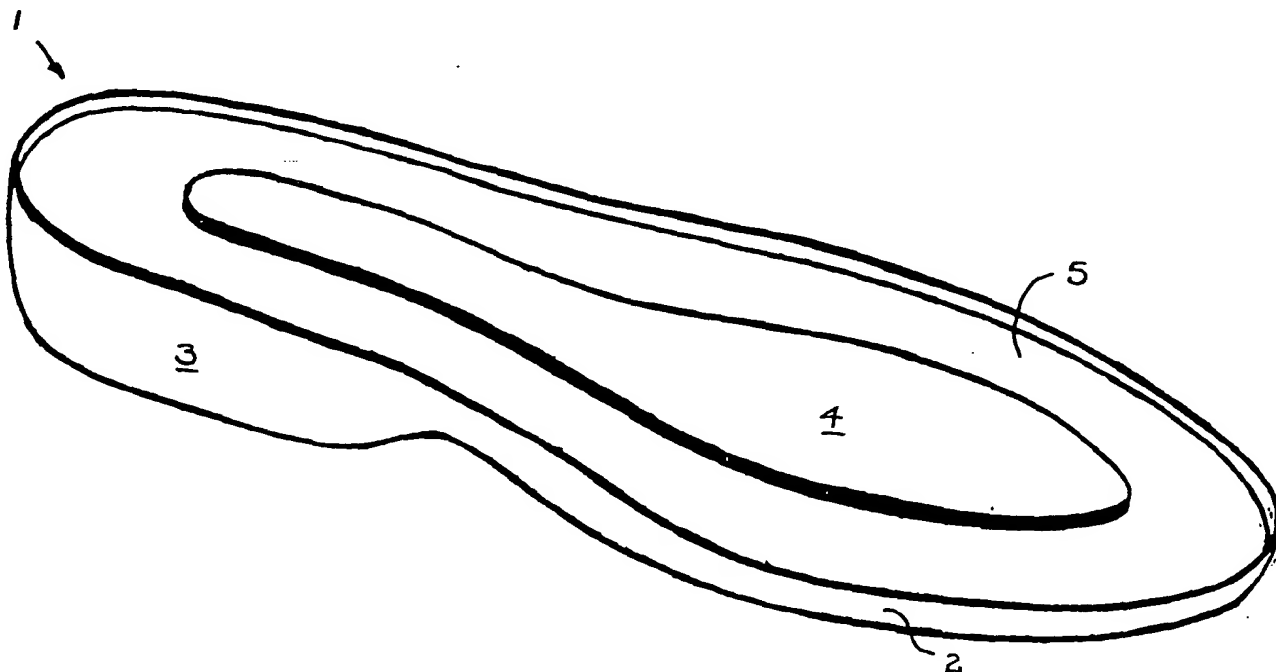
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (21) International Application Number: PCT/AU92/00223 (22) International Filing Date: 18 May 1992 (18.05.92) (30) Priority data: PK 6225 17 May 1991 (17.05.91) AU (71) Applicant (for all designated States except US): PHURNESS PTY. LTD. [AU/AU]; A.C.N. 007 412 900, 3 Leanne Drive, Eltham, VIC 3095 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only) : PURNELL, Andrew, Thomas [AU/AU]; 9 Caltowie Court, Research, VIC 3095 (AU). PURNELL, Robert, Dowell [AU/AU]; 4 Wildlife Parade, North Balwyn, VIC 3104 (AU). | | | (74) Agent: GRIFFITH HACK & CO.; 601 St. Kilda Road, Melbourne, VIC 3004 (AU). (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US. Published With international search report. |

(54) Title: AN ANTISTATIC SHOE SOLE



(57) Abstract

An antistatic shoe sole (1) comprising a polyurethane outer sole (2) having predetermined electrical resistance characteristics, and a rubber sole insert (4) having predetermined electrical resistance characteristics positioned adjacent the outer sole (2), wherein, static electricity in the sole insert (4) is capable of discharging from the sole insert (4) along a path of least resistance through the outer sole.

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TITLE

AN ANTISTATIC SHOE SOLE

BACKGROUND OF THE INVENTION

The present invention relates to an antistatic shoe
5 sole.

In the manufacture of some products, for example
electronic devices, stray static electricity can damage or
significantly disrupt the operation of the products.
Sensitive computers, integrated circuits and computer
10 software and data which are stored on magnetic tape or disk
may even be destroyed by stray static electricity.
Consequently, extensive measures are taken during the
manufacture and use of these products in order to reduce
the risks of damage by stray static electricity. People
15 using and manufacturing the products are usually one of the
most significant sources of stray static electricity.
Consequently, it is essential to discharge static
electricity from people who may come in contact with
products which may be adversely effected by static
20 electricity. Usually working areas in which such products
can be found have a grounded floor or grounded mats which
are able to discharge the static electricity from people
walking on the floor or mats by conducting the static
electricity from the people to the floor. The only contact
25 people have with the floor are usually through their shoe
soles, but static electricity does not readily discharge
through conventional shoe soles since the shoe soles do not
adequately conduct static electricity from the body of the
person to the floor. Therefore, in order to improve static
30 electricity discharge it is desirable to have an antistatic
shoe which readily discharges static electricity.

DISCUSSION OF PRIOR ART

It is known to produce antistatic shoes with rubber

soles, but these shoes suffer from a number of disadvantages. Rubber soles are often heavy and may mark floors. In order to overcome these problems, it is preferably to use polyurethane rather than rubber, since
5 polyurethane is a lighter product which lasts longer and is non-marking. However, polyurethane is not within the desired range of electrical resistance for conducting static electricity. Antistatic shoes usually have an electrical resistance property of between 75 kOhms and 50
10 MOhms, (as measured by the standard test specified in British Standard 2050). Polyurethane does not have these resistance properties and it is therefore necessary to enhance the antistatic properties of the polyurethane by the introduction of additives to the polyurethane.
15 However, polyurethane is a blown material and the dispersion of additives within the material is not homogenous due to the poor mixing characteristics of polyurethane. Furthermore, in order to achieve adequate antistatic properties it is necessary to add a large amount
20 of additives, but this deteriorates the quality of the polyurethane. Consequently, simply adding antistatic additives to polyurethane to make an antistatic polyurethane shoe sole is not possible.

SUMMARY OF THE INVENTION

25 The present invention attempts to overcome one or more of the above problems.

 According to the present invention there is provided a shoe sole comprising:

 a polyurethane outer sole having predetermined
30 electrical resistance characteristics, and

 a rubber sole insert having predetermined electrical resistance characteristics positioned adjacent the outer sole,

 wherein, static electricity in the sole insert is
35 capable of discharging from the sole insert along a path of

least resistance through the outer sole.

It is preferred that the shoe sole further comprises a conductive inner sole positioned adjacent the sole insert so as to improve the discharge of static
5 electricity from a wearer of a shoe having the shoe sole through the inner sole, the sole insert and the outer sole.

DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will now be described, by way of example only, with reference to
10 the accompanying drawings, in which;

Figure 1 is a perspective view of a preferred embodiment of the present invention,

Figure 2 is a top view of the sole of Figure 1, and

Figure 3 is a preferred embodiment of a shoe having
15 an antistatic sole of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the shoe sole 1, as illustrated in Figures 1, 2 and 3, is comprised of an outer sole 2 and a sole insert 4. The shoe sole 1 comprises a
20 heel section 3 and a toe section 5. The sole insert 4 is comprised of a strip of rubber which is smaller than the shoe sole, but of a similar shape. The sole insert 4 extends substantially along the centre of the outer sole 2, from about the centre of the heel section 3 towards the toe
25 section 5 of the shoe sole. The sole insert 4 is recessed in the outer sole 2 to prevent movement of the sole insert 4.

The outer sole 2 is manufactured from a microcellular polyurethane containing approximately 5% of
30 quaternary ammonium, or a similar compound, and 2 to 3% carbon black to impart electrical resistance characteristics to the polyurethane material for the necessary antistatic properties. The additive is supplied by ICI Australia Limited under the trade mark "Additive I".

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This polyurethane sole has a resistance of approximately 40 MOhms in a standard wet/dry test and a resistance of 20 MOhms in a wet/wet test conducted according to British Standard 2050. In general, the resistance cannot be
5 reduced any further since a maximum of approximately 10% additives can be added to polyurethane before it starts to break down. Therefore, the resistance of the polyurethane is reduced as far as possible, but since the improved electrical resistance characteristics are still not
10 adequate for an antistatic shoe sole, the characteristics have to be improved with the aid of a sole insert 4 having a lower electrical resistance. The combination of the outer sole 2 and the sole insert 4 thus provides an antistatic shoe sole with the required electrical
15 resistance characteristics.

The sole insert 4 is manufactured from a rubber containing various additives which results in a sole insert with a resistance of approximately 1 MOhms. Because rubber does not suffer from poor mixing, as polyurethane does, the
20 additives are dispersed evenly through the insert resulting in even conductivity. Furthermore, the rubber can be given more additives than polyurethane, therefore resulting in a much lower resistance value compared to polyurethane. The base formulation for the antistatic rubber insert is as
25 follows:

| | | |
|----|--------------------------|-------|
| | Natural Rubber SMR20 | 80.00 |
| | Synthetic Rubber SBR1502 | 20.00 |
| | Zinc Oxide | 5.00 |
| | Stearic Acid | 1.00 |
| 30 | Antioxidant TMQ | 1.00 |
| | Accelerator CBS | 1.50 |
| | Accelerator DPG | 0.25 |
| | Carbon Black N220 | 10.00 |
| | Carbon Black N774 | 55.00 |
| 35 | Aromatic Oil | 8.00 |
| | Sulphur | 2.00 |

183.75

Carbon black is a substantially pure form of finely divided carbon. Carbon black N220 is a conductive black and its proportions to carbon black N774 are adjusted to provide the required electrical resistance. Increasing the amount of carbon black N220, provides a lower resistance value for the rubber.

In use, static electricity from a person wearing a shoe having the shoe sole of the preferred embodiment of the present invention, collects in the sole insert 4. In order to discharge to the ground, the static electricity finds a path of least resistance through the polyurethane outer sole 2. This location would usually be near the toe of the shoe, since the shoe sole is at its thinnest point in this area. However, due to the uneven mixing of the antistatic additives within the polyurethane, the path of least resistance is not always the shortest path in distance through the shoe sole, but rather the path which builds up in the heel 3 of the shoe 1, then the static electricity will most likely flow further down the sole insert 4 and find a discharge path through the thinner toe section 5 of the outer sole 2. In the preferred embodiment the thickness of the sole is at least 2 to 3 millimetres. Figure 4 illustrates a shoe 10 having an outer sole 2 in accordance with a preferred embodiment of the present invention. The shoe 10 has a leather upper 6 with a polyurethane outer sole 2, as described above. In order to improve the conductance of static electricity from a wearer of the shoe to the shoe sole, the shoe is provided with a conductive inner sole 9 which is in direct contact with the sole insert 4. The leather outer 6 is tucked under the insole 9, as shown at 7 and 8, and continues around the circumference of the shoe sole so that the leather abuts

the sole insert 4. In use, static electricity flows from the body of a wearer of the shoe, through the conductive inner sole 9 to the sole insert 4 and then through the polyurethane outer sole 2 along a path of least resistance.

5 The polyurethane outer sole has advantages over the prior art rubber soles in that the polyurethane soles are non-marking, have better antislip characteristics, last longer and are lighter to wear. Furthermore, unlike rubber, the polyurethane sole is resistant to
10 petrochemicals and acids, thus making it ideal in hazardous environments.

 It will be appreciated that features of the above invention may be varied for different applications the foregone description of the embodiments of the invention
15 have been presented for purposes of illustration only. It is not intended to be exhaustive or to limit the invention to the embodiments, and many variations and modifications will be obvious to one skilled in the art.

CLAIMS:

1. A shoe sole comprising:
a polyurethane outer sole having predetermined electrical resistance characteristics, and
a rubber sole insert having predetermined electrical resistance characteristics positioned adjacent the outer sole,
wherein, static electricity in the sole insert is capable of discharging from the sole insert along a path of least resistance through the outer sole.
2. A shoe sole according to claim 1, wherein the sole insert is a strip extending substantially along the centre and on an inner surface of the outer sole.
3. A shoe sole according to claim 2, wherein the sole insert extends from the heel of the shoe sole to the toe of the shoe sole.
4. A shoe sole according to any one of the preceding claims, wherein the sole insert is recessed in the outer sole.
5. A shoe sole according to any one of the preceding claims, further comprising a conductive inner sole positioned adjacent the sole insert so as to improve the discharge of static electricity through the inner sole, the sole insert and the outer sole from a wearer of a shoe having the shoe sole.
6. A shoe sole according to any one of the preceding claims, wherein the outer sole has an electrical resistance of approximately 40 MOhms in a standard wet/dry test and an

electrical resistance of approximately 20 MOhms in a standard wet/wet test in a test conducted according to British Standard 2050.

7. A shoe sole according to any one of the preceding claims, wherein the outer sole is comprised of polyurethane having approximately 5% quaternary ammonium at 2 to 3% carbon black.

8. A shoe sole according to any one of the preceding claims, wherein the sole insert has an electrical resistance of approximately 1 MOhm.

9. A shoe sole according to any one of the preceding claims, wherein the sole insert is comprised of a rubber material having approximately 5% carbon black N220.

10. A shoe sole according to any one of the preceding claims, wherein the outer sole has a thickness of at least 2mm.

11. A shoe having a shoe sole as claimed in any one of the preceding claims.

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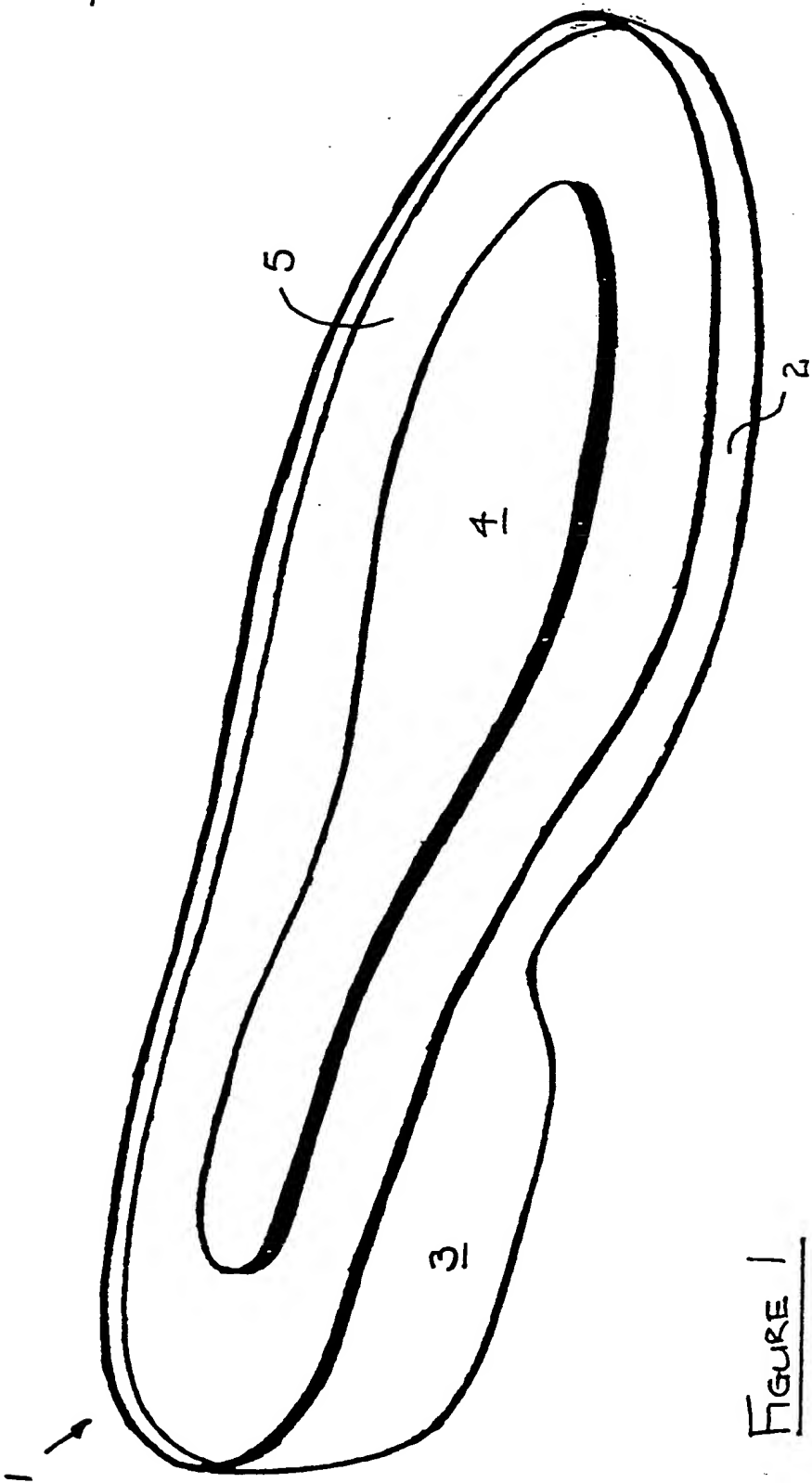


FIGURE 1

2/2

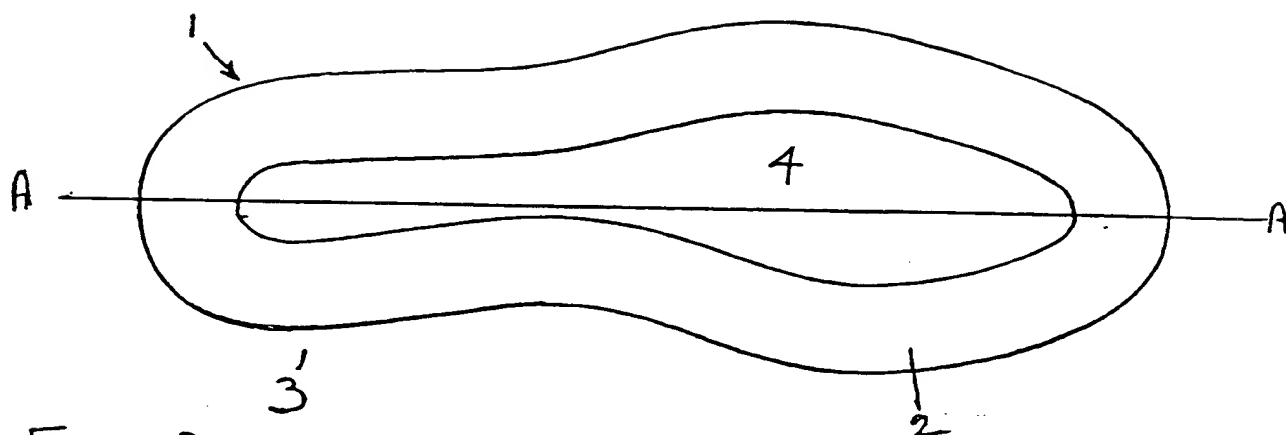


Figure 2

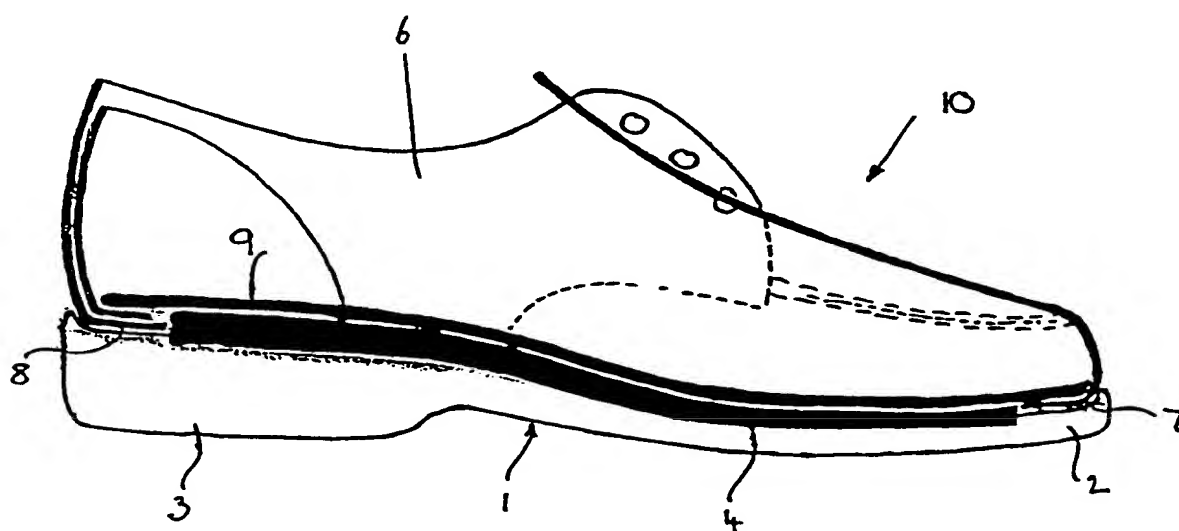


Figure 3

INTERNATIONAL SEARCH REPORT

| | | |
|---|---|------------------------------------|
| I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ | | |
| According to International Patent classification (IPC) or to both National Classification and IPC Int. Cl. ⁸ A43B 7/36, 13/12 | | |
| II. FIELDS SEARCHED | | |
| Minimum Documentation Searched ⁷ | | |
| Classification System | Classification Symbols | |
| IPC | A43B 7/36, 13/04, 13/12 | |
| Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸ | | |
| AU : IPC as above and A43B 13/00, 13/02 | | |
| III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ | | |
| Category [*] | Citation of Document, ¹¹ with indication, where appropriate of the relevant passages ¹² | Relevant to Claim No ¹³ |
| A | WO,A, 91/02469 (UK SHOE GROUP LIMITED) 7 March 1991 (07.03.91) (& AU,A, 59687/90) | |
| A | BE,A, 847437 (HUTH) 14 February 1977 (14.02.77) | |
| A | DE,A, 2147904 (REUTER MASCHINEN UND WERKZEUGBAU GmbH) 29 March 1973 (29.03.73) | |
| A | DE,A, 3827598 (BAYER AG) 15 February 1990 (15.02.90) | |
| A | EP,A, 79572 (DUCROS) 25 May 1983 (25.05.83) | |
| (continued) | | |
| <p>[*] Special categories of cited documents : ¹⁰</p> <p>"A" Document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> | | |
| IV. CERTIFICATION | | |
| Date of the Actual Completion of the International Search 8 July 1992 (08.07.92) | Date of Mailing of this International Search Report 28 July 1992 (28.07.92) | |
| International Searching Authority AUSTRALIAN PATENT OFFICE | Signature of Authorized Officer B. DASHWOOD | |

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

- | | |
|---|--|
| A | Derwent Abstract Accession no. 78-35932A/20 Class A83 JP,A, 53-038453 (HIROSHIMA KASEI KK) 8 April 1978 (08.04.78) |
| A | Derwent Abstract Accession no. 85-234384/38 Class P22 JP,A, 60-153802 (TSUKIHOSHI KASEI KK) 13 August 1985 (13.08.85) |
| A | Derwent Abstract Accession no. 88-061922/09 Class P22 JP,A, 63-019102 (HIROSHIMA KASEI KK) 26 January 1988 (26.01.88) |
| A | Derwent Abstract Accession no. 88-351049/49 Class P22 JP,A, 63-264002 (SEIAICHO RUBBER KK) 31 October 1988 (31.10.88) |
| A | Derwent Abstract Accession no. 90-352520/47 Class P22 JP,A, 02-255102 (KOKOKU CHEM IND KK) 15 October 1990 (15.10.90) |

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4a

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 92/00223**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document Cited in Search Report | | Patent Family Member | |
|--|---------|----------------------|------------|
| WO | 9102469 | AU 59687/90 | GB 8918444 |
| DE | 3827598 | EP | 355001 |

END OF ANNEX



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